Educating Preschoolers about Sun Safety

ABSTRACT

Objectives. This feasibility study examined whether a sun safety curriculum designed for and administered to preschoolers affects their cognition (knowledge, comprehension, application) regarding sun safety.

Methods. Twelve classes of 4- to 5-year-olds were recruited from local preschools and randomly assigned to an intervention group or a control group. The intervention group received an investigator-developed sun safety curriculum; the control group did not. Children in both groups were tested at the beginning of the study about their cognition related to sun safety. They then received posttests 2 and 7 weeks following the pretest.

Results. The curriculum had a significant effect on the knowledge ($P = .01$) and comprehension ($P = .006$) components of cognition. The application component of cognition was not significantly changed by the curriculum.

Conclusions. A structured curriculum was found to be an efficacious means of enhancing knowledge and comprehension of sun safety in preschool children. At the preoperational developmental stage, however, children may not be able to apply such knowledge and comprehension. (*Am J Public Health.* 1995;85:939–943)

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Introduction

No publications have addressed the impact of a developmentally based and age-appropriate curriculum on preschool children's cognition and attitudes concerning sun safety. Such research is warranted, however, because excessive exposure to solar radiation is known to play a role in the etiology of skin cancers.[1] A link may exist between severe sunburn in childhood and greatly increased risk of skin cancers, including melanoma, later in life.[2–8] Many skin cancers can be prevented by practicing such behaviors as reducing sun exposure during peak hours of intensity, wearing protective apparel, and regularly applying sunscreen.[2] Stern et al.[9] estimated that regular use of sunscreen with a sun protection factor of 15 during the first 18 years of life would reduce the lifetime incidence of nonmelanoma skin cancer by 78% and possibly reduce the risk of melanoma.

Behaviors that young children adopt may affect their chances of developing cancer later in life,[9–11] so sun safety education should ideally begin in early childhood. Furthermore, because adult habits are difficult to change, it is better to acquire preventive habits early in life.[12] Sun safety, however, has not been a focus of preschool disease prevention educational research, which to date has focused on general health education and behavioral change,[13–15] smoking intentions and awareness,[16–18] and nutrition.[19,20]

This study examined the feasibility of a developmentally based and age-appropriate sun safety curriculum for preschoolers. Specific aims were to (1) identify preschoolers' cognition (knowledge, comprehension, application) of sun safety, and (2) test whether the curriculum improves preschoolers' cognition and attitudes about sun safety. We hypothesized that, as a group, 4- to 5-year-old children taught about sun safety through the curriculum (an intervention group) would score significantly higher on the posttests than those children not taught the curriculum (a control group).

Methods

This experimental study[21] was based on Piaget's theory of cognitive development.[22] Piaget designated four major stages of cognitive development: sensineuromotor (from birth to age 2), preoperations (ages 2 to 7), concrete operations (ages 7 to 11), and formal operations (ages 11 to 16). Four- and 5-year-olds are in the preoperational stage, developing beginning forms of reasoning and classification, showing some ability to see things from others' perspectives, and showing early signs of complex thought. Their attention is usually centered on a limited visual aspect of a stimulus; however, with progression into more operational stages, they are better able to understand more abstract concepts.[23] Thus, preschool educators commonly base their instruction on the sequence of changes from preoperational to concrete operational thinking.[24]

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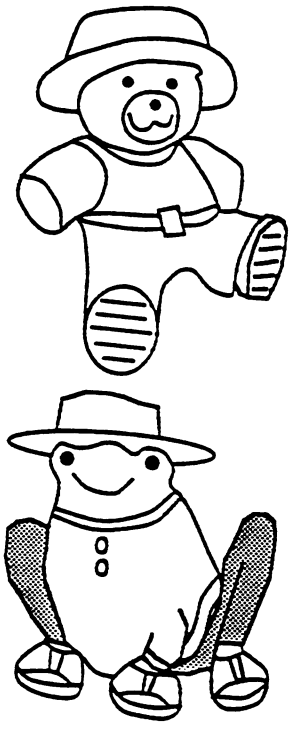

FIGURE 1—The characters Sunny the Bear and Shadow the Frog conveyed sun-safe messages throughout the curriculum.

Recruitment and Sample

The sample for this study included 12 classes of 4- to 5-year-old children. Sample size was calculated by using a formula appropriate for the comparison of means in the setting of cluster randomization, assuming a .05 level of significance and 90% power to detect a 2-point change in the mean score for a given section of the instrument.[25]

Sample recruitment began with a list of state-certified preschools obtained from the local child care association. This list categorized schools by zip code, and zip codes were restricted to three distinct geographic areas, each containing 16 to 18 schools. A random numbers table was then used to select and telephone four schools from each area to assess study eligibility. These interviews continued until four eligible schools per area were identified.

Minimum study eligibility requirements for school participation were (1) willingness of the director to participate; (2) evidence of a structured, full-day, full-week program; (3) one classroom of 4- to 5-year-old children with a minimum of 15 students; (4) the ability to send a consent form home with the child for parents to sign, and (5) the ability of children to understand English and of their parents to read and understand English. Ethnic composition, socioeconomic status, and male/female ratio for the selected schools were examined to ensure reasonable comparability within areas. One class in each of the 12 schools constituted the final sample.

Following the selection of schools, classes within each geographic area were randomly assigned to intervention and control groups using a random permuted blocks method.[26] Classes in six schools were assigned to the intervention group and classes in the other six schools were assigned to the control group.

Specific Methods

Be Sun Safe Curriculum. This curriculum comprised three units, each addressing a simple sun safety concept. Sun safety is the development and practice of positive health habits aimed at protecting skin from sunburn and staying healthy. The sun safety concepts identified from the literature and validated by health care experts and early childhood specialists were *cover up, find shade,* and *ask for sun-safe things.* The curriculum emphasized the relationship between sun safety and overall health.

The curriculum began with materials for the teacher that review tanning, the ultraviolet spectrum, skin, skin cancer, and skin cancer risk factors. Each unit (45 to 50 minutes in length) was consistently structured and contained teacher information, purpose and objectives, materials available for loan, classroom and take-home activities, key words, and learning resources. Interactive activities included a puppet show, sun safety classification games, art activities, and sun safety songs and storybooks. Throughout the activities, key characters Sunny the Bear and Shadow the Frog (Figure 1) conveyed and reinforced sun-safe messages.

Children's Cognition and Attitudes Assessment. This criterion-referenced, self-report, pictorial instrument was developed to measure children's sun safety cognition (i.e., the need to wear sun-protective apparel, to stay in the shade, and to ask for sun-safe things such as sunscreen products). Self-report inventories have the children choose or comment on pictures that they identify with, reveal their perceptions about how others see them, or show their preferred interests or activities. Pictures or photographs have been used by others because preschoolers need only to point or make limited comments in response, which is consistent with their cognitive developmental stage.[16,17,22,27]

Based on Bloom's *Taxonomy of Educational Objectives,*[28] testing of the children's cognitive domain was divided into three levels: knowledge, comprehension, and application. Knowledge is demonstrated by the ability to recall or remember the specifics of the instruction. Comprehension is an understanding of the instruction, which is shown by making use of ideas without relating them to other situations. Application is the ability to transfer the concepts—not behaviors—learned in one situation into another situation or setting. Knowledge, comprehension, and application, therefore, represent increasing levels of cognition.

The testing involved showing children gender-specific photographs depicting sun-safe situations and asking structured questions about the photographs. Each section of the assessment (knowledge, comprehension, and application) was scored separately to allow for interpretation of the three levels of cognition. A score of 1 indicated a correct response and 0 indicated an incorrect response; nonresponses were also documented. Experts in skin cancer and early childhood education determined the face validity of the assessment instrument, which went through several phases of pilot testing and modification before reaching its present state.

Procedures

After Institutional Review Board approval was granted, informed consent from parents and preschools was obtained. Trained interviewers then administered the assessment instrument to children in the intervention and control groups at the preschool. Children in the intervention group were tested prior to administration of the curriculum, and at 2 weeks (posttest 1) and 7 weeks (posttest 2) following the curriculum. Children in the control group (those not receiving the curriculum) were tested on the same schedule.

Using a team-teaching approach, two research assistants taught the *Be Sun Safe* curriculum to each class in the intervention group, with instruction occurring on 3 consecutive days (one unit per day). Control schools received a condensed version of the curriculum after testing of both groups was completed.

Data Analysis

Descriptive statistics compared the demographic characteristics of children in the intervention and control groups. Further analysis compared the groups with respect to mean pretest and posttest scores on each section (knowledge, comprehension, and application) of the assessment instrument. Because of sample size constraints and expected attrition (e.g., from absences on posttesting days, school dropouts, and refusals to participate), only data from children who had completed the pretest and one or both posttests were considered evaluable.

An analysis of covariance (ANCOVA) compared levels of knowledge, comprehension, and application of sun safety between control and intervention groups.[29] Pretest measures of these three areas served as the covariate in analyses to allow for estimation of mean posttest differences among subjects in the two groups. Partial F tests indicated whether there were significant differences between the two groups with respect to adjusted mean posttest scores.

Results

Consent forms were distributed to 290 parents, 167 (58%) of whom completed and returned them. We pretested 150 children for whom parents had provided consent, with children's absences accounting for differences in the numbers of those who consented versus those who were pretested. Of the children pretested, 28 received posttest 1 only, 20 received posttest 2 only, and 8 received no posttest. Thus, the final sample consisted of 142 (95%) children who received either posttest 1, posttest 2, or both.

Table 1 presents the demographic characteristics of the study subjects. (Such data could be collected only on consenting families.) Although empirical and theoretical evidence do not suggest that boys and girls at this age would have different cognitive responses to such a curriculum, we examined sex as a possible modifier variable, given the difference in numbers of boys and girls in the intervention and control groups. We observed no modifying effect of sex in any analyses; that is, two-way interactions between study group and sex were nonsignificant ($P > .10$) in all ANCOVA models and are not reported.

The results of the ANCOVA analyses are shown in Table 2. The scoring of the instrument included categories for "correct," "incorrect," and "no response." Differences in the numbers of evaluable responses in each section reflect nonresponses in a given section. After adjustment for the pretest score, knowledge of sun safety differed significantly between the intervention and control groups at both first and second posttests. Similar results were found for tests of sun safety comprehension. These effects were most noticeable following posttest 1 (knowledge: $P = .01$; comprehension: $P = .006$) although the effects were still significant following posttest 2. However, we found no significant differences in the ability of the intervention and control groups to apply their sun safety knowledge accurately.

TABLE 1—Demographic Characteristics of Preschool Children in Sample

	Children Pretested		Children Posttested[a]	
	Control Group (n = 80)	Intervention Group (n = 70)	Control Group (n = 76)	Intervention Group (n = 66)
Mean age, y (SD)	4.7 (.4)	4.9 (.4)	4.7 (.4)	4.9 (.4)
Age range	4.0, 5.5	4.2, 5.8	4.0, 5.5	4.2, 5.8
Sex, %				
Male	62	39	62	39
Female	38	61	38	61
Race/ethnicity, %				
White	69	60	69	61
Hispanic	12	17	13	18
Other	19	23	18	21

[a]Includes those receiving either one or both posttests.

TABLE 2—Mean Scores for Knowledge, Comprehension, and Application Determined by the Children's Cognition and Attitudes Assessment[a]

	Control Group (n = 68)		Intervention Group (n = 54)		*F* Statistic (*P*)[b]
	Mean (SD)	No.	Mean (SD)	No.	
Knowledge					
Pretest	2.1 (1.3)	65	2.5 (1.2)	52	
Posttest 1	2.3 (1.4)	65	3.1 (1.2)	52	6.474 (.01)
Pretest	2.0 (1.3)	57	2.4 (1.1)	52	
Posttest 2	2.5 (1.3)	57	3.2 (1.2)	52	4.756 (.03)
Comprehension					
Pretest	1.4 (1.3)	56	1.4 (1.4)	48	
Posttest 1	2.1 (1.6)	56	3.0 (1.9)	48	7.828 (.006)
Pretest	1.4 (1.5)	52	1.5 (1.4)	42	
Posttest 2	2.5 (1.8)	52	3.5 (2.5)	42	4.69 (.033)
Application					
Pretest	1.5 (0.8)	38	1.7 (0.8)	31	
Posttest 1	1.6 (0.8)	38	1.9 (0.9)	31	2.306 (.134)
Pretest	1.5 (0.9)	27	1.6 (0.9)	35	
Posttest 2	1.8 (0.8)	27	2.1 (0.9)	35	.998 (.322)

[a]Unadjusted mean scores.
[b]*F* statistic and *P* value obtained from comparison of adjusted mean posttest scores for control versus intervention groups.
[c]No. = number responding on both the pretest and the indicated posttest section.

Discussion

This study showed that a structured sun safety curriculum significantly increased preschoolers' knowledge and comprehension of sun safety. These results are similar to those of Parcel et al.,[15] who

field-tested the Preschool Health Education Program in 105 four-year-olds and found that it contributed to learning and potentially influenced health-related behavior. Consistent with Piagetian theory, knowledge and comprehension may have been enhanced by the interactive format of the curriculum, which incorporated individual and group activities to stimulate preschoolers' thinking about sun safety.[22,30]

The increase in knowledge and comprehension was most noticeable following posttest 1, which was given 2 weeks after the curriculum. The effect was still significant following posttest 2, given 7 weeks after the curriculum. Since we had asked intervention schools to engage in "normal" (usually minimal) sun safety activities following administration of the curriculum, this short-term retention of sun safety knowledge and comprehension is encouraging. Repetition of curriculum activities by preschool teachers would further enhance preschoolers' ability to incorporate sun safety concepts into their long-term memory.[30]

Knowledge and comprehension scores of children in the control group improved slightly from pretest to posttest. This could possibly be attributed to a positive test effect (the increased attention of control teachers and children to sun safety issues) or to the geographic setting and timing of the study.[31] Southern Arizona has more than 300 sunny days a year and among the highest skin cancer rates in the world, so community awareness of skin cancer prevention is high. Additionally, the children were tested in late spring, a time when local media begin their sun awareness campaigns.

We attempted to make the curriculum developmentally appropriate for preschoolers, considering both the children's age and their developmental stage. Although the curriculum affected knowledge and comprehension significantly, testing of the application component did not reveal significant improvement. This finding is consistent with aspects of child development theory. Children in this sample were 4 to 5 years old and were in the preoperational stage of cognitive development; at this stage, their cognition tends to remain egocentric and idiosyncratic, and they lack the ability to use causal reasoning.[22]

Limitations of the Children's Cognitive and Attitudes Assessment instrument also may explain the low application scores. No children were depicted in photographs used for the application question, which may have made the photographs less interesting to the respondents. Additionally, self-report methods are susceptible to problems of guessing and of responding in a particular direction to questions.[32] Similar to the findings of Kishchuk et al.,[18] our study found little intra-individual consistency in responses, even though the children appeared to understand the interviewers' requests. Despite these limitations, the closed question format of the assessment instrument provided a more objective measure than would a recording of children's likes or dislikes or a collection of information from casual conversations with them.[32]

Another limitation of this research was the lack of a direct observational component.[33] Four- to 5-year-olds who were unable to make the correct application in a testing situation may actually be the children who remembered to find shade when on the playground. Also, we were unable to compare children who participated with those who did not in terms of demographic information and family health motivations.

The importance of developing parallel educational material for parents should be noted. Parents in this study received general skin cancer prevention brochures and handouts that provided comprehensive information about sunscreens and sun-safe practices they can teach their children. Although we did not systematically evaluate the effectiveness of these parent materials, others have found that parents exert a powerful influence on their children's preventive practices.[16,17,20] It is reasonable to assume that 4- to 5-year-old children need parental help in applying their newfound knowledge, given their developmental stage and the limited control they have in this area of their life (e.g., they are unable to buy sunscreen for themselves.) However, health education at this age is still important to help children learn what to ask for in terms of healthy options and become more compliant with parental sun safety efforts.

Conclusions

This feasibility study represents an initial attempt to teach preschoolers about sun safety using a developmentally appropriate, research-based approach. Although the curriculum did not attempt to link cognition with behavioral change, it did have a positive effect on children's knowledge and comprehension concerning sun safety, and it was well received by children, parents, and preschools. Further research must determine whether the curriculum can be linked to short- or long-term behavioral change and whether it can be effectively implemented by preschool staff. Sun safety educational programs that present basic concepts and activities that stimulate learning may be a start in developing positive sun safety habits in young children. □

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European Conference on Combination Toxicology to Be Held in the Netherlands

The European Conference on Combination Toxicology will be held from October 11 through 13, 1995, in the Congress Centre Koningshof, Veldhoven, the Netherlands. This first European Congress aims to introduce the concepts of combination toxicology, to present current research on chemical mixtures, and to discuss the use of present knowledge in risk assessment and standard setting.

The goal of the conference is to discuss in depth experimental designs to study the effects of defined chemical mixtures, and to open the discussion between regulators and scientists on how to deal with combined exposures in human risk assessment and standard setting. The conference will conclude with a panel discussion evaluating the state of scientific knowledge, future research needs, and the degree of consensus within the scientific and regulatory community about considering combined exposures in risk assessment and regulations.

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